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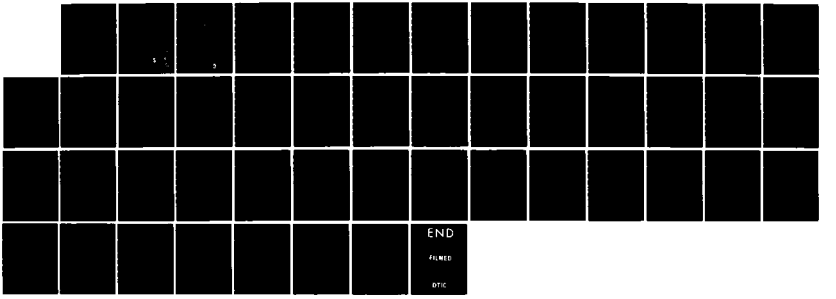

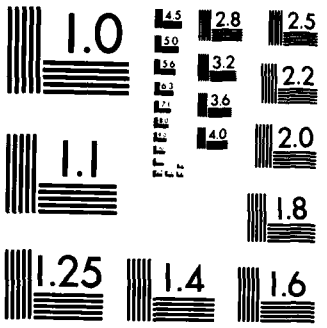

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METREK DIVISION

MTR-7610
Volume III

Airport and Airway Costs Incurred in the Public Interest

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ABSTRACT

The analysis presented in this report is a part of the study on Airport and Airway Costs and User Cost Responsibility for 1977-1986. During the course of the study, FAA costs incurred in the public interest were identified as costs to be allocated to the public sector and not to the airport and airway system users. In addition to a theoretical evaluation of alternative treatments of such costs, five specific areas are explored: providing ATC services to small communities, supporting military requirements of ATC system elements, providing weather data to nonaviation users, supporting regulatory activities of safety, medicine and environment, and operating the national capital airports.

ACKNOWLEDGEMENTS

Invaluable assistance was provided by a number of individuals in their areas of expertise during the course of this analysis. The authors wish to acknowledge the contributions provided by the Office of Aviation Policy and Airways Facilities Services (FAA), Administrative Sciences Corporation, and members of the Air Transportation Systems Division of The MITRE Corporation.

SUMMARY

Based on an evaluation of alternative methods of assigning public cost responsibilities, it was decided to allocate FAA costs incurred in the public interest to the public sector and not to the airport and airway system users. In addition, FAA costs that are directly recoverable from the users at the time of dispensing the services are also excluded from costs to be allocated to airport and airway system users. The total reduction in the projected FAA cost base due to public interest items and directly recoverable elements are estimated at $395 million in 1977 which increases to $463 million in 1986 (in constant 1976 dollars). In current dollars, the estimates are $426 million in 1977 and $817 million in 1986.

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1. INTRODUCTION

In allocating the Federal Aviation Administration's (FAA) projected cost base for 1977-1986 (Reference 1) consideration should be given to FAA costs incurred in the public interest. Sections 2 and 3 of this report discuss the theoretical considerations of the treatment and identification of such costs. The analysis presented in subsequent sections deals with the actual identification and quantification of FAA's costs incurred in public interest in four specific areas:

1. Providing air transportation service to small communities.

2. Supporting military requirements of the civilian ATC system elements.

3. Providing weather service to the nonaviation community.

4. Providing services in the areas of safety, medicine, and environment.

In addition to the FAA costs incurred in "Public Interest," there are other FAA costs which are not directly attributable to the users as a part of the provision of airport and airway services. Certain service costs can be recovered from specific users at the time the service is dispensed. For example, FAA certification and licensing costs can be charged to the persons receiving certificates or licenses at the time of their issuance. Other FAA expenditures, apart from "public interest" outlays which should also be excluded from the allocation of airport and airway costs to users are discussed in Section 7.

2. TREATMENT OF PUBLIC COST RESPONSIBILITIES

2.1 Alternative Methods of Assigning Public Cost Responsibilities

Four methods were considered for incorporating public interest factors in the allocation of FAA costs. These four alternative methods are:

- allocate costs to the public that are equal to the value of public benefits
- no allocation of costs to the general public
- allocate costs to the public in proportion to the ratio of public benefits to total benefits
- allocate costs to the public that are specifically attributable to actions taken in the public interest.

2.2 Evaluation of Alternative Methods

Following is a brief discussion of the implications and merits of each of the four methods of treating areas of public interest. These methods are summarized in Table 2-1. It is followed by the selection of a preferred method which is employed in the final cost allocation computations that were made as part of this study (Reference 7).

The selection of a preferred method was based on the criteria of allocative efficiency, equity, and ability to pay. These criteria are discussed more fully in the cost allocation report (Reference 7).

The first method, which allocates costs to the public that are equal to benefits received by the public, could result in some users being charged prices that are less than marginal costs. This theoretical weakness could lead to allocative inefficiency. Problems can arise when using this method because the sum of user and public benefits might exceed total costs. For instance, if the value of public benefits is large, then application of this method could lead to the anomalous result of some users paying small amounts, or even nothing, even though they receive benefits and impose costs on the system.

The method that provides no credit for costs incurred in the public interest goes to the opposite extreme by providing no public financial support, thereby making users bear the entire cost burden. As public requirements impose marginal costs on the system and as external (noninternalized by users) benefits exist, this method is contrary to accepted economic theory and practice.

TABLE 5-3

FAA RCS COSTS ASSOCIATED WITH
MILITARY REQUIREMENTS
(IN MILLIONS OF 1976 DOLLARS)

YEAR	EN ROUTE	TERMINAL
1977	$51.7	$ 9.7
1978	$52.3	$ 9.9
1979	$51.2	$11.0
1980	$51.2	$11.4
1981	$51.9	$11.4
1982	$54.0	$11.5
1983	$55.3	$11.7
1984	$55.2	$12.2
1985	$56.4	$12.5
1986	$57.5	$12.6

TABLE 5-2

RCS COSTS OF FAA COMMUNICATIONS SYSTEMS
(IN MILLIONS OF 1976 DOLLARS)

YEAR	EN ROUTE	TERMINAL
1977	$103.4	$ 96.7
1978	$104.6	$ 98.8
1979	$102.4	$109.7
1980	$102.4	$114.0
1981	$103.8	$113.8
1982	$108.0	$114.6
1983	$110.6	$117.2
1984	$110.4	$122.3
1985	$112.8	$124.8
1986	$115.0	$126.3

SOURCE: Reference 13

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*Conversion factor for 1975 dollars to 1976 dollars is 1.084 (Reference 16).

TABLE 5-1

UNIT O&M COSTS OF VORTAC AND VOR/DME INSTALLATIONS
(IN THOUSANDS OF 1976 DOLLARS*)

1. VORTAC SITES

SINGLE - $48.5

DUAL - $56.7

2. VOR/DME SITES

SINGLE - $41.3

DUAL - $46.4

3. DIFFERENTIAL COST FOR VORTAC VERSUS VOR/DME

SINGLE - $ 7.2

DUAL - $10.3

SOURCE: REFERENCE 12

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*The conversion factor for 1973 dollars to 1976 dollars used in this analysis is 1.303 (Reference 16)

system. Consequently, the difference in the operating and maintenance costs of 706 VORTAC sites and equivalent VOR/DME equipment can be attributed solely to defense requirements. These sites consist of 358 single VORTAC installations and 348 dual VORTAC installations (Reference 12). The unit costs of the different sites are shown in Table 5-1 (Reference 12). These costs have been converted into 1976 dollars to be consistent with the cost analysis of this study.

The differential O&M costs of 358 single and 348 dual installations are estimated to total $6.2 million annually in constant 1976 dollars. The number of VORTAC sites are not projected to change in the future and the differential costs are expected to remain the same during the period 1977-1986. Subsequently, the military requirements costs associated with the navigation systems is assumed to stay at the same level.

5.4 Communications System

Two elements of the ATC communications system were identified as being maintained by the FAA exclusively for military purposes. The first consists of the dual UHF radio channels in the radio communications systems of the terminal and en route centers. The second element is the leaseline costs associated with drops to military installations from the FAA communications circuits.

5.4.1 Radio Communications System

The radio communications system (RCS) consists of UHF channels and VHF channels. The civilian ATC system uses the VHF channels with UHF being maintained for communication and control of military aircraft.

A 1976 study by Computer Sciences Corporation (Reference 13) has addressed the costs of FAA communications systems for the period 1976-2001. The aggregate costs of the RCS are shown in Table 5-2. Within the CSC study, no detailed breakdown of the RCS costs into UHF and VHF channels were available. The results of an FAA sponsored study (Reference 14) indicated that UHF related equipment and leaselines accounted for an estimated 50% of the en route RCS. In the terminal area, the proportion of UHF related elements is significantly lower. Based on the number of UHF and VHF channels in the existing facilities, an engineering estimate of 10% of terminal RCS was derived for UHF related costs. The resultant allocation of RCS costs for military purposes are shown in Table 5-3.

5. FAA COSTS IN SUPPORT OF MILITARY REQUIREMENTS FOR ATC SYSTEM ELEMENTS

FAA costs associated with military operations at FAA-operated facilities are allocated to the military by treating them as one of the system users (Reference 7). In addition to these types of costs, any clearly-allocable costs incurred by FAA in maintaining elements of the civil Air Traffic Control (ATC) system to support military requirements are incurred for the benefit of the nation as a whole. Hence, FAA costs associated with such activities should not be allocated to the airport and airway users alone, but rather to the general public.

To estimate the extent of these costs, a review of each aspect of the existing ATC system was conducted. The objective was to identify military costs in future years (1977-1986) and hence, any sunk costs were not considered. The findings are discussed in the following sections.

5.1 Terminal and En Route Control Centers

No specific future tower or control center structure costs were identifiable as solely or primarily required for defense related activity. Further, costs of the R-2508 enhancement project being developed jointly by the Department of Defense (DOD) and FAA in California (Reference 8) are being shared in an equitable manner--proportional to the use, i.e., FAA's share of the cost was commensurate with its use in civil applications.

5.2 Surveillance System

A number of the existing surveillance sites will continue to be used jointly by the FAA and the DOD during the period 1977-1986. A list of joint use Air Route Surveillance Radars (ARSR) and Airport Surveillance Radars (ASR) can be found in References 9 and 10, respectively. Under a memorandum of agreement between the FAA and DOD (Reference 11) appropriate shares of facility operating costs are to be borne directly by DOD and will not be reflected in FAA budgets or operating costs.

5.3 Navigation System

Currently, 706 existing TACAN sites are maintained for military purposes. These TACAN sites are colocated with VOR installations. If it were not for the military requirements, VOR/DME could be substituted at these installations to serve the civilian ATC

4. FAA COST OF PROVIDING ATC SERVICES AT SMALL COMMUNITIES

Financial assistance is provided by the Federal Government under the Aviation Act of 1958 to insure adequate air service to small communities. The subsidy program, administered by the Civil Aeronautics Board, is a manifestation of public desire to have air carrier transportation at locations which might not otherwise be able to economically support comparable commercial service. Subsidy eligible flights into small community airports sometimes resulted in individual airports receiving FAA air traffic control facilities which would not have been provided in the absence of these flights. Therefore, a portion of the costs for terminal and en route services is deemed to be incurred in the public interest.

There are 96 airports with FAA air traffic control towers which are presently served by subsidized carriers and another 28 towered airports which were previously served by subsidized carriers but have been abandoned (Reference 4). The cost of FAA services at these 124 airports should be analyzed to determine its potential for assignment as costs incurred in the public interest. A similar analysis of the route-miles flown was conducted primarily based on air carrier traffic statistics (Reference 5). The subsidy-eligible route miles flown in FY 1976 accounted for a negligible (four-tenths of one percent) portion of the total route miles. Hence, any costs incurred in public interest associated with en route operations were not considered. Thus, the relevant costs are related to the terminal ATC facilities, equipment, controllers, maintenance and support at towered airports.

To determine what portion of these expenses should be eliminated from the cost base, numerous allocation alternatives were examined. Consideration was given to both the present and past subsidy status of the airports, and the relationship between subsidy eligible flights and tower establishment criteria (both current and historical). The evaluation and measurement of all alternatives along with a description of the procedures for identifying small community points and the cost estimating methodology is presented in Administrative Sciences Corporation's report titled "Airport and Airway Costs Incurred in Servicing Small Communities" (Reference 6). The recommended alternative is that the FAA costs at 67 communities which (1) presently receive subsidized service; (2) originally required the presence of subsidized service in order to qualify for traffic control towers; and (3) do not meet present tower establishment criteria be assigned to the public sector as costs incurred in public interest. These services incurred in the public interest are estimated to have an associated annual cost of $39.1 million (in FY76 dollars).

TABLE 3-1

RELEVANCY OF CLAIMED PUBLIC BENEFITS

BENEFIT	CHARACTERISTICS OF BENEFITS					
	NONUNIQUE	COUNTED INTERNALLY	EXTERNAL, BUT DOUBLE-COUNTED	CANCELLATION BY COUNTERVAILING FACTORS	DIFFICULTY IN QUANTIFYING	NOT SIGNIFICANT
SAFETY						
Non-user safety						
Medicine & environment						
MILITARY						
Military operations at civilian facilities[a]						
Features added for military requirements						
Military standby					X	
IMPROVED LEVEL OF SERVICE						
Efficiency of resource usage		X			X	
Postal service benefits		X				
Service to small communities						
Availability of medical services	X	X			X	X
Expansion of communication & cultural opportunities		X			X	
ECONOMIC						
Contributions to GNP & national income	X		X			
Balance of trade	X		X			
Increased land values	X			X		
Employment	X		X	X		
GENERAL WELL-BEING						
Consumer standby					X	X
National pride & prestige					X	X
Non-aviation uses of airport property	X			X		
Technological spinoffs	X				X	
Relieve demands on other substitutes	X			X	X	X
Weather data						

[a] Associated costs are allocated by the cost allocation procedure for the military operations at civilian airports.

X - Benefit category eliminated for listed characteristic.

Also, benefits that are not significant relative to other cost and benefit items were eliminated from consideration. Additionally, benefits that are intangible or not readily quantifiable were eliminated. The question of how to treat these nonquantifiable elements often rises in cost-benefit and other analyses. Rather than distorting the analysis by inclusion of highly imprecise estimates, a usual practice is to identify them outside of the quantitative analysis for consideration by decision-makers.

Table 3-1 summarizes the relevancy, with respect to justifying subsidy, of the most frequently cited and most significant purported public benefits. Based on the criteria employed and discussed earlier, the following public benefits have been evaluated as being appropriate for justifying subsidy:

- safety
- medicine and environment
- military operations at civilian facilities
- service to small communities
- weather data.

Not all purported benefits could be classified as being completely adherent or completely non-adherent to any particular evaluation criterion. Thus, some of the judgments made in Table 3-1 were necessarily subjective. This factor is not critical because rejection was always based on more than just a single subjective and possibly contestable decision.

Quantification of the costs incurred in providing these public benefits is provided in the following sections. These costs are incorporated in the final cost allocation equations as recommended in Section 2 (Reference 7).

uniquely with air transportation. Unique benefits generally are associated with the unique characteristics of air transportation, and not with factors common to numerous other industries such as the requirement of labor as an input to production. Even though external benefits might exist--this is normally a justification of subsidy--it is improper to subsidize the airport and airway system based on these nonunique benefits because our society, in general, does not provide subsidy to other industries or modes based on their nonunique benefits. Thus, subsidies to air transportation based on nonunique benefits could create competitive imbalances and are not considered in this analysis.

Purported public benefits that have already been captured internally by users should be eliminated as justification for subsidy. Efficiency of resource usage is an example of this as low cost air transportation is a benefit that is already captured by the airlines and other users. If benefits of this type are counted fully at each point where they ripple through the economy, then overcounting will result.

External benefits that overlap other external benefits should be eliminated from consideration because they, too, would otherwise be double-counted. For instance, the benefits of increased GNP, increased income, and increased employment are at least partially overlapping and interrelated. Mistakenly counting all of these benefits in full would result in a false and exaggerated impression of the true level of benefits.

Inter-personal and inter-regional cancellation of benefits provides a final reason for reducing the length of the list of relevant public benefits. In these cases, countervailing factors can result in benefits being washes--one group's gain is another's loss. For example, a gain in aviation-related employment in one community might be achieved at the expense of a competing community. In these cases, subsidy is probably not desirable at the national level even though it might be desirable from the perspective of a local community.

3.2.2 Applying Criteria to Determine Relevant Benefits

This list of purportedly relevant benefits is reduced in this subsection by application of the criteria described in Section 3.2.1. It was not necessary, in eliminating benefits for external double-counting, to determine to what extent benefits overlap because all overlapping benefits were eliminated for other reasons as well.

to separate Federal airport and airway benefits from air transportation benefits, only the benefits incrementally arising from Federal support are relevant. In quantifying the costs of providing public benefits later in this report, only differential Federal airport and airway cost items (i.e., those in FAA budget) are included. Benefits derived primarily from local/state subsidy or user volition are not included.

This report deals primarily with positive valued externalities (i.e., public benefits). Negative valued externalities (i.e., public disbenefits) such as noise and accidents also accrue from air transportation. While it is outside the scope of this cost allocation study to assess these publicly borne costs against users, it is appropriate to offset benefits with disbenefits when they are produced simultaneously and necessarily by a single distinct process. Examination of the public benefits that were used to justify subsidy showed that none of these benefits were directly linked with offsetting disbenefits.

Every action, including providing financial support to the airport and airway system, has an associated opportunity cost. In some cases, these opportunity costs can be represented sufficiently well by cost of capital. In other circumstances, more complicated factors come to play. For instance, the jobs that are created in aviation by injections of subsidy might be fully offset if the alternative to this use was to divert these funds to a more labor intensive sector of the economy. Accordingly, when calculating justifiable Federal financial support, opportunity costs should enter into the formulae.

The previous paragraphs discussed factors that, if ignored, might lead to overstating relevant public benefits. The following paragraphs describe criteria to be used for outright rejection of inappropriate benefit items. These benefit rejection criteria include:

- nonuniqueness
- internal double-counting
- external double-counting
- interpersonal and interregional cancellation

Many of the public benefits that are ascribed to air transportation--increased employment, improved balance of trade, and increased national income are just a few--would be associated with virtually any economic activity (e.g., automobile manufacturing) and not

Military benefits are among the most important public benefits arising from the air transportation system. Military benefits fall into several categories: routine operations at civil facilities, design of civil facilities to meet special military requirements (e.g., UHF channels), and standby potential for use in times of national emergency.

Benefits derived from an improved level of service include: more efficient use of resources (labor and capital) with eventual pass-on to the public, improved postal service, increased acceptability of geographic dispersion (primarily through service to small communities), greater availability of health and medical services, expansion of communication and cultural opportunities, and facilitation of mobility. A major element in this topic area is service to small communities from which other indirect benefits such as decreased congestion in urban regions is derived. Many of these benefits are internalized by system users.

Another category of public benefits is direct enhancement of national economic health. These benefits include: increased GNP, increased national income, improved balance of trade, enhanced land values, and increased employment levels. To some extent, these benefits are overlapping. Similar benefits are often claimed for many other public projects outside of the aviation sector.

The final category of benefits is a catchall that might be termed general well-being. This category includes: consumer standby, national pride and prestige, non-aviation uses of airport property, technological spinoffs, collection and distribution of weather data, and relief of demands on other modes and substitutes. The arguments in support of many of these items are rather tenuous.

3.2 Relevant Incremental Benefits

A list of public benefits associated with air transportation has been constructed in the previous section. This section identifies criteria which can be used to aid in accepting or rejecting specific public benefits as justification for subsidy. These criteria are then applied to the earlier determined list of public benefits.

3.2.1 Identification and Treatment of Relevant Incremental Benefits

Initially, any benefit that is attributable to the air transportation system as a whole, but not to the Federal role in the airport and airway system should be eliminated. While it is difficult

3. IDENTIFICATION OF AREAS OF FAA COSTS INCURRED IN PUBLIC INTEREST

Section 2 specified a recommended method of treating costs incurred in the public interest. Specifications of appropriate public cost elements is required for application of this method. Accordingly, this section discusses the nature of public benefits and the relevancy of these benefits for justifying subsidy. Several pertinent areas are identified. These areas are treated in detail later in this report.

3.1 Claimed Public Benefits

Many public benefits have been attributed to air transportation (Reference 2). However, not all are appropriate as justification for Federal financial support of the airport and airway system. Frequently cited public benefits are summarized in this subsection. An evaluation of proper treatment of these items within the framework of this cost allocation study is made in the following subsection.

Public benefits can be arranged into five categories:

- Safety benefits
- Military benefits
- Benefits derived from improved level of service
- Direct economic benefits
- General well-being of the country.

Not all benefit items fall precisely into a single distinct category. Alternative classification schemes might be equally or more suitable. However, this classification scheme is a convenient form of organization for describing public benefits in the following paragraphs.

Safety is one of the most apparent benefits derived from Federal participation in the airport and airway system. Also included in this category are certain medical and environmental benefits. FAA contributes directly (e.g., prevention of accidents and regulation of aircraft noise) and also indirectly (e.g., medical and environmental research) in this area. These benefits accrue to both users and the public.

The third method, which allocates costs in proportion to benefits received by the public and private sectors, provides only a tenuous relationship between prices and costs. Furthermore, this method uses total benefits, rather than marginal benefits, which is the more relevant quantity. Accordingly, use of this value of service method could lead to a misallocation of resources.

The final method, which allocates specifically attributable costs to the public, is a straightforward marginal cost method. This method is generally consistent with the marginal cost method that was recommended for cost allocation and can be modified to conform precisely with that method subject to data limitations (Reference 7).

This last method is the only one of the four that is acceptable from a theoretical point of view. Not only does it meet the basic selection criteria, but it also satisfies pragmatic considerations. Use of this marginal-cost type of method would likely lead to a high degree of allocative efficiency. It does not provide subsidy beyond the extent necessary to activate public benefits. Finally, it is equitable, as users would not be unfairly burdened with public costs and, at the same time, none would be getting a free ride.

Implementation of this method involves a simple extension from the basic technique described above. To refresh the reader, in this method, costs attributable to providing public benefits are deducted from total costs, and remaining costs are allocated among user groups. In this cost allocation study, the military is considered as a distinct user group. Thus in applying this method, military operating benefits (i.e., direct military use of civilian facilities) should be allocated directly to military users in the same manner as marginal costs are allocated to general aviation and air carrier users.

Other public benefits should be credited as subsidy by deducting their costs from the total cost base. Where the marginal costs of these latter benefits are associated with an increment coincident with a distinct facility (e.g., a control tower and associated equipment at a small community), then the marginal costs which should be deducted from the total cost base are one and the same as the total costs of providing that facility. Details of the application of these principles can be found in a companion document (Reference 7).

TABLE 2-1

ALTERNATIVE METHODS OF INCORPORATING PUBLIC INTEREST FACTORS IN COST ALLOCATION FORMULAE

Method	Description
Allocate costs to the public equal to the value of public benefits	Subtract value of public benefits (or some subset of public benefits) from total costs; allocate remaining costs among users.
No allocation of costs to the general public	Provide no credit for public benefits; allocate all costs among users.
Allocate costs to the public as the ratio of public benefits to total benefits	Allocate total costs in proportion to benefits with public benefits being considered as well as private benefits.
Allocate costs to public that are specifically attributable to providing public benefits	Subtract identifiable marginal/ incremental costs incurred in providing public benefits from total costs; allocate remaining costs among users.

5.4.2 Voice Communications Systems

The military requirements costs associated with leaselines for the FAA voice communication system (VCS) was estimated as a product of an appropriate factor and total VCS costs (Reference 13). The factor used (0.068) represented a ratio of the number of military approach facilities to the total facilities operated by the FAA (Reference 15). Estimated military costs are shown in Table 5-4. Also shown in Table 5-4 are the estimates of the leaseline costs associated with UHF channels. As in the preceeding subsection, the costs associated with UHF channels are estimated as 50% of en route and 10% of terminal air-ground costs.

TABLE 5-4

FAA VCS COSTS IN SUPPORT OF MILITARY REQUIREMENTS
(IN MILLIONS OF 1976 DOLLARS)

↓ ELEMENT YEAR →	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
6.8% of Total VCS Costs*	5.2	5.4	5.7	5.9	6.0	6.3	6.6	6.9	7.1	7.4
Air-Ground Leaseline Costs**										
50% of En Route	5.0	5.3	5.7	6.0	6.1	6.4	6.8	7.1	7.5	7.8
10% of Terminal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
T O T A L	10.3	10.8	11.5	12.0	12.2	12.8	13.5	14.1	14.7	15.3

*Based on drops to military facilities.

**Associated with UHF channels.

6. FAA COSTS OF PROVIDING WEATHER DATA TO NONAVIATION USERS

6.1 Rationale for Inclusion in Costs Incurred in Public Interest

Part of the annual FAA budget is appropriated for weather-related expenditures. A portion of these costs is incurred in support of the needs of NOAA (National Oceanic and Atmospheric Administration).

The services provided by FAA to NOAA are dispensed by NOAA to both aviation and nonaviation users. There are three basic cost items: information for charts, use of the FAA communications system, and surface weather observations. The basic flow of information and service from FAA to users through NOAA is shown in Figure 6-1.

The purpose of Section 6 is to estimate the costs incurred by the FAA on behalf of NOAA which benefit nonaviation users. Since aviation users alone benefit from FAA charting information gathered for NOAA, it is not necessary to consider this cost further. Each of the two remaining cost items will be considered. Estimates of the total cost of services provided to NOAA are presented first, followed by the estimates of the portion of the costs which are allocated exclusively to nonaviation users.

6.2 Cost Development

6.2.1 Surface Weather Observations

Sufficient data are not available from NWS (National Weather Service) stations to meet all the needs of NWS and other users. FAA augments NWS's efforts in data acquisition by supplying surface weather observations to NWS from 227 of the 292 FAA-operated FSS's (flight service stations) (Reference 17). The cost incurred by FAA to gather weather data at those 227 stations may be estimated based on the manpower required.

In 1972, FAA developed a staffing standard model that is applied annually to each FSS (Reference 18) to estimate manpower requirements for nine categories of labor. Of these, three have application to the FAA effort to collect and distribute surface weather data. Two of the three [TWEB (continuous transcribed weather broadcasts) and PATWAS (Pilot's automatic telephone weather answering service)] concern aviation users exclusively and need not be considered further. This leaves "weather observations" as the applicable cost category related to the FAA provision of data to NOAA.

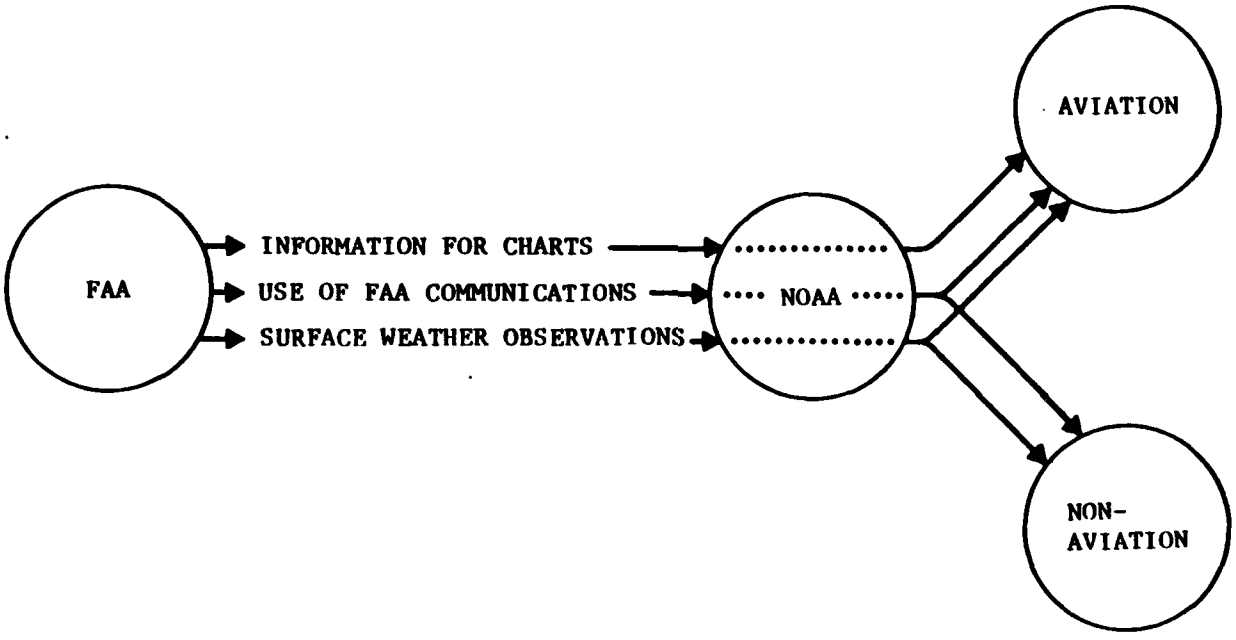

FIGURE 6-1
FAA WEATHER RELATED ACTIVITIES AND ULTIMATE BENEFICIARIES

The 1976 staffing standard model output for "weather observations" is shown by state in Table 6-1. Man-year requirements are given for 190 of the 227 FSS's which take surface weather observations. A total of 179.5 man-years was allocated for the 190 stations. To account for those stations for which no data is available, the total for 190 stations was increased proportionally, resulting in a manpower estimate of 214.5 man-years for the 227 FSS's. The personnel taking the observations are members of the AAT (air traffic) group and, in 1976, each AAT man-year resulted in an estimated annual cost to the Government of $25,280* (Reference 19). Therefore, FAA's estimated cost of surface weather observations taken in 1976 becomes $5.423 million.

Despite the fact that some instruments which can mechanize part of the process of taking surface weather observations will be implemented in the near future, no instrument is expected to be operational by 1986 which will totally eliminate the manpower requirement. Neither is the process likely to become more labor intensive. Therefore, the cost to FAA, from 1977 through 1986, for taking surface weather observations has been estimated to remain constant at $5.423 million in 1976 dollars.

6.2.2 Weather-Related Communications

Costs are incurred by FAA due to NOAA's use of the FAA communication system to collect and distribute weather information. These costs may be estimated by FAA communication system elements which contain the parts of the communications network used for weather-related tasks. The FAA communication system, as described in a report written by Computer Sciences Corporation (CSC) (Reference 20), consists of the grid of 16 mutually exclusive and collectively exhaustive elements shown in Table 6-2. Also included are 1976 costs for each element reproduced from Reference 13.

Transmission of weather information for NOAA use is limited to the FSS national/international elements of the data communications system (DCS) (refer to Table 6-2). However, the cost associated with service B should be eliminated from these two elements. This is because service B deals with the exchange of flight planning messages and with the transfer of administrative messages, neither of which involves collection and distribution of weather information. In its description of the FAA communication system (Reference 13), CSC estimated the cost of the service B circuits at $1.280 million in FY 1972. To be compatible with other costs in this analysis, this cost must be inflated to 1976 dollars.

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* Includes direct manpower, overhead, retirement and related Government costs.

TABLE 6-1

1976 STAFFING STANDARD FOR "WEATHER OBSERVATIONS" AT FLIGHT SERVICE STATIONS
(Man-Years)

STATE	NUMBER OF AIRPORTS	MAN-YEARS REQUIRED	STATE	NUMBER OF AIRPORTS	MAN-YEARS REQUIRED
Alabama	4	4.0	Nebraska	2	1.7
Alaska	10	7.5	Nevada	3	3.0
Arizona	2	2.0	New Hampshire	1	1.0
Arkansas	5	4.0	New Jersey	1	1.0
			New Mexico	6	6.0
California	16	15.4	New York	7	7.0
Colorado	4	4.0	North Carolina	3	2.6
Connecticut	0	0	North Dakota	4	4.0
Delaware	0	0	Ohio	3	3.0
			Oklahoma	4	4.0
Florida	5	5.0	Oregon	3	3.0
Georgia	4	3.7	Pennsylvania	7	6.7
Hawaii	0	0	Rhode Island	0	0
Idaho	2	2.0	South Carolina	3	2.6
Illionis	2	2.0	South Dakota	2	2.0
Indiana	2	2.0			
Iowa	4	4.0	Tennessee	4	2.7
			Texas	13	12.4
Kansas	7	6.4			
Kentucky	4	4.0	Utah	2	1.3
Louisiana	3	3.0	Vermont	1	1.0
			Virginia	3	2.7
Maine	3	3.0			
Maryland	1	1.0	Washington	7	6.4
Massachusetts	0	0	West Virginia	4	4.0
Michigan	6	6.0	Wisconsin	4	3.4
Minnesota	3	3.0	Wyoming	4	4.0
Mississippi	2	2.0			
Missouri	4	4.0	TOTAL	190	179.5
Montana	6	6.0			

TABLE 6-2

ELEMENTS OF THE F.A.A. COMMUNICATIONS NETWORK AND THEIR FORECAST 1976 COSTS
(Millions of 1976 Dollars)

SYSTEMS FUNCTIONS:	En Route	Terminal	FSS Flight Service Stations	National and International
VCS Voice Communication System	35.4	25.4	10.8	1.6
RCS Radio Communication System	110.1	84.2	35.7	0.2
DCS Data Communication System	115.3	23.2	16.3	15.6
TCS Technical Control Service	0.9	18.9	6.9	-

Source: Reference 13.

Using the implicit price deflator for GNP associated with government purchases of goods and services (Reference 16), this results in a cost of service B of $1.783 million in 1976 dollars. In order to predict weather-related costs through 1986, forecast costs for the DCS-FSS and DCS-National elements (Reference 13) were combined and converted to 1976 dollars. The cost of service B, $1.783 million, was subtracted from each sum. The results are shown in Table 6-3.

6.3 Estimation of Costs Attributable to Nonaviation Users

The annual FAA cost incurred for weather data transmission to NOAA is estimated as the sum of the annual costs for surface weather observations and communications. For 1977 through 1986, these are shown in columns 1-3 of Table 6-4 in 1976 dollars. However, the weather data is provided by NOAA to both aviation and nonaviation users. The proportion of effort exerted in gathering data for nonaviation users was estimated in the 1973 cost allocation study to be 2/3 (Reference 21). There has been negligible change since then in weather data gathering technique and use. Application of this fraction to the total weather cost results in the forecasts shown in column 4 of Table 6-4. These estimates represent the projected costs to be incurred by FAA from 1977 through 1986 in the interests of nonaviation users for weather information.

TABLE 6-3

FAA COMMUNICATIONS COSTS INCURRED ON BEHALF OF NOAA
(Millions of 1976 Dollars)

YEAR	COST
1977	$30.809
1978	$31.669
1979	$32.374
1980	$33.179
1981	$34.013
1982	$35.377
1983	$36.786
1984	$38.229
1985	$39.669
1986	$41.139

TABLE 6-4

SUMMARY OF FAA COSTS INCURRED ON BEHALF OF NOAA
(EXCLUDING COSTS LIMITED TO AVIATION USERS)
(Millions of 1976 Dollars)

YEAR	COMMUNICATIONS	SURFACE OBSERVATIONS	TOTAL WEATHER	NON-AVIATION WEATHER
1977	$30.809	$5.423	$36.232	$24.155
1978	31.669	5.423	37.092	24.728
1979	32.374	5.423	37.797	25.198
1980	33.179	5.423	38.602	25.735
1981	34.013	5.423	39.436	26.291
1982	35.377	5.423	40.800	27.200
1983	36.786	5.423	42.209	28.139
1984	38.229	5.423	43.652	29.101
1985	39.669	5.423	45.092	30.061
1986	41.139	5.423	46.562	31.041

7. FAA COSTS ASSOCIATED WITH SAFETY, MEDICINE, ENVIRONMENT AND DIRECTLY RECOVERABLE ELEMENTS

A portion of the annual FAA expenditure supports regulatory activities in the fields of aircraft safety, environment and aviation medicine. Regulatory actions benefit the general public in areas such as noise abatement, pollution control, and applied research for the elimination of biomedical factors causing accidents. Consequently, costs in support of regulatory activities are excluded from the cost base to be allocated.

In addition, FAA incurs costs that are directly recoverable from the users at the time of dispensing the services. These costs relate to items such as certification, registration, licensing, and physical examinations. Costs associated with operating the National Capital Airports are financed through airport charges and can be classified under the directly recoverable costs.

All of the above mentioned costs are allocated to the public sector and are excluded from the cost allocated to airport and airway system users. The previous 1973 Cost Allocation Study (Reference 22) also pursued similar guidelines for the cost base.

The appropriate costs involving the items discussed in this section have been extracted and are presented in Table 7-1 to correspond with the cost base format. The aviation medicine portion of R&D is based on the 1977 budget (Reference 23). The same source is used to arrive at the proportional costs for centralized training and direct support and staff.

TABLE 7-1

FAA COSTS ASSOCIATED WITH SAFETY, MEDICINE, ENVIRONMENT
AND DIRECTLY RECOVERABLE ELEMENTS

(IN MILLIONS OF 1976 DOLLARS)

YEAR / ELEMENT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
R&D (Aviation Medicine)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Administration of Flight Standards	142.3	150.7	154.7	158.6	163.4	168.5	173.1	176.8	181.7	186.6
Administration of Medical Programs	8.5	9.1	9.3	9.5	9.8	10.5	10.9	11.2	11.5	11.9
Airport Administration (Safety Certification Cost)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Centralized Training (Related to Flt. Stds. & Medical Program)	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1
Direct Support & Staff (Related to Flt. Stds. & Medical Program)	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Facilities, Engineering & Development*	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3
National Capital Airports	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4

* Includes contractual research activities related to the environment.

8. SUMMARY

The annual reduction in the FAA cost base due to public interest items and directly recoverable elements are summarized in Tables 8-1 and 8-2. In constant 1976 dollars, the total increases from $395 million in 1977 to $463 million in 1986. In current dollars, the 1977 estimate is $426 million increasing to $817 million in 1986.

TABLE 8-1
SUMMARY OF REDUCTIONS IN FAA COST BASE
(IN MILLIONS OF 1976 DOLLARS)

Elements \ Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Service to Small Communities	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
Military Requirements	77.9	79.2	79.9	80.8	81.7	84.5	86.7	87.7	89.8	91.6
Nonaviation Use of Weather Service	24.2	24.7	25.2	25.7	26.3	27.2	28.1	29.1	30.1	31.0
Safety, Environment & Medicine	225.7	234.7	238.9	243.0	248.1	253.9	258.9	262.9	268.1	273.4
National Capital Airports	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4
Total	395.3	406.1	411.5	417.0	423.6	433.1	441.2	447.2	455.5	463.5

TABLE 8-2
SUMMARY OF REDUCTIONS IN FAA COST BASE
(IN MILLIONS OF CURRENT DOLLARS)

Elements \ Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Service to Small Communities	42.1	44.7	47.2	49.9	52.8	55.7	58.7	61.8	65.3	68.8
Military Requirements	84.0	90.6	96.6	103.2	110.4	120.5	130.3	138.9	150.3	161.5
Nonaviation Use of Weather Service	26.1	28.3	30.5	32.8	35.5	38.8	42.2	46.1	50.4	54.6
Safety, Environment & Medicine	243.3	268.5	288.8	310.3	335.2	362.1	389.1	416.4	448.8	482.0
National Capital Airports	30.6	32.5	34.3	36.3	38.4	40.5	42.7	45.0	47.5	50.1
Total	426.2	464.5	497.6	532.6	572.3	617.6	663.1	708.2	762.4	817.1

APPENDIX A

GLOSSARY

A.C./ AC	AIR CARRIER
A-P/ AP/ ARPT	AIRPORT
AAT	FAA AIR TRAFFIC SERVICE
ADAP	AIRPORT DEVELOPMENT AID PROGRAM
ADM/ ADMIN	ADMINISTRATION
ADV	ADVISORY
AFTN	AERONAUTICAL FIXED TELECOMMUNICATIONS NETWORK
AOPA	AIRCRAFT OWNERS AND PILOTS ASSOCIATION
ARSR	AIR ROUTE SURVEILLANCE RADAR
ARTCC	AIR ROUTE TRAFFIC CONTROL CENTER
ARTS	AUTOMATED RADAR TRAFFIC CONTROL SYSTEM
ASC	ADMINISTRATIVE SCIENCES CORPORATION
ASR	AIRPORT SURVEILLANCE RADAR
ATC	AIR TRAFFIC CONTROL
AVP	FAA OFFICE OF AVIATION POLICY
C-AP	CAPITOL AIRPORTS
CAB	CIVIL AERONAUTICS BOARD (SEE ALSO TRACAB)
CAP	CAPITOL
CENT	CENTRALIZED
CONUS	CONTINENTAL UNITED STATES
CSC	COMPUTER SCIENCES CORPORATION
CTR	CENTER (EN ROUTE)
DCA	WASHINGTON NATIONAL AIRPORT
DCS	DATA COMMUNICATIONS SYSTEM
DEV	DEVELOPMENT
DIR	DIRECTION
DME	DISTANCE MEASURING EQUIPMENT
DOD	DEPARTMENT OF DEFENSE
DOT	DEPARTMENT OF TRANSPORTATION
E&D	ENGINEERING AND DEVELOPMENT
F ST/ FLT STDS	FLIGHT STANDARDS
F&E	FACILITIES AND EQUIPMENT
F,E&D	FACILITIES, ENGINEERING AND DEVELOPMENT
FAA	FEDERAL AVIATION ADMINISTRATION
FAC	FACILITY
FREQ	FREQUENCY
FSS	FLIGHT SERVICE STATIONS
FY	FISCAL YEAR
G.A./ GA	GENERAL AVIATION
GAMA	GENERAL AVIATION MANUFACTURERS ASSOCIATION

APPENDIX A

GLOSSARY (Contd)

GOVT	GOVERNMENT
GRANTS	GRANTS-IN-AID
I&M/ IN & MAT	INSTALLATION AND MATERIAL
IAD	DULLES INTERNATIONAL AIRPORT
IFR	INSTRUMENT FLIGHT RULES
ILS	INSTRUMENT LANDING SYSTEM
JFK	JOHN F. KENNEDY INTERNATIONAL AIRPORT
LRIC	LONG RUN INCREMENTAL COST
LRMC	LONG RUN MARGINAL COST
MAINT	MAINTENANCE
MDW	CHICAGO MIDWAY AIRPORT
MED	MEDICAL (PROGRAMS)
MIL	MILITARY
MSL	MEAN SEA LEVEL
NAFEC	NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER
NAS	NATIONAL AIRSPACE SYSTEM
NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASP	NATIONAL AVIATION SYSTEM PLAN
NATL/ NTI	NATIONAL
NAVAIDS	NAVIGATION AIDS
NBAA	NATIONAL BUSINESS AIRCRAFT ASSOCIATION
NOAA	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NWS	NATIONAL WEATHER SERVICE
O&M	OPERATIONS AND MAINTENANCE
OPS	OPERATIONS
ORD	CHICAGO O'HARE INTERNATIONAL AIRPORT
OST	OFFICE OF THE SECRETARY OF TRANSPORTATION
PATWAS	PILOT'S AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE
PGP	AIRPORT PLANNING GRANT PROGRAM
R&D	RESEARCH AND DEVELOPMENT
R&M	RELOCATION AND MODIFICATION
R,E&D	RESEARCH, ENGINEERING AND DEVELOPMENT
RCAG	REMOTE COMMUNICATIONS, AIR TO GROUND
RCS	RADIO COMMUNICATIONS SYSTEM
RTR	REMOTE TRANSMITTER/RECEIVER
S.E.E.	STANDARD ESTIMATE OF ERROR

APPENDIX A

GLOSSARY (Concluded)

S&S	STAFF AND SUPPORT
SRMC	SHORT RUN MARGINAL COSTS
SUP	SUPPORT
TACAN	TACTICAL AIR NAVIGATION AID
TCS	TECHNICAL CONTROL SERVICE
TR	TRAFFIC
TRACAB	TERMINAL RADAR CONTROL FACILITY COLOCATED WITH A CONTROL TOWER
TRACON	TERMINAL RADAR CONTROL FACILITY
TRN	TRAINING
TWEB	TRANSCRIBED WEATHER BROADCASTS
TWR	TOWER (TERMINAL)
U.S.	UNITED STATES
UG3RD	UPGRADED THIRD GENERATION
UHF	ULTRA HIGH FREQUENCY
UNICOM	AERONAUTICAL ADVISORY STATION
VCS	VOICE COMMUNICATIONS SYSTEM
VFR	VISUAL FLIGHT RULES
VHF	VERY HIGH FREQUENCY
VOR	VHF OMNI-RANGE (NAVIGATION AID)
VORTAC	COLOCATED VOR AND TACAN

APPENDIX B

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